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ANTARCTICA AS A POTENTIAL IMPACT AREA FOR TESTING THE ICBM

Introduction

Test firings of the ICBM by both the US and the USSR have already taken place at range distances approximating 5,000 nautical miles (nm). This distance represents the current operational capability of both nations as evidenced by actual known tests within the past year over existing range facilities. Greater range distances, up to 7,500 nm, will without doubt be attained within a few years with the development by the US of larger and more powerful thrust engines. The Soviets, by their outstandingly successful launchings of Luniks and earth satellites, have already demonstrated and claimed the thrust capability for a 7,500-nm missile. If testing facilities for the ICBM are to keep pace with increasing range capability, those nations possessing the ICBM must look far beyond their borders for suitable target areas of impact. The great east-west breadth of the USSR is roughly only half the distance necessary for testing the foreseeable ICBM. The most suitable land areas of impact, from the standpoint of sparsity of population and non-use or wasteland, are the great desert regions of the earth, small isolated oceanic islands (mainly in the Pacific Ocean), and the vast politically unresolved continent of Antarctica.

Only by overflight of great ocean areas will it be possible to attain sufficiently long arcs for full range testing of the ICBM at 7,500 nm. Although the launch site may be selected well in the interior of a continent, the US has found it preferable to launch its test missiles from coastal areas. Initial stages are then dropped into the sea, thereby

minimizing the risk to population and property in the launch area. To test the future 7,500-nm missile, the impact area should include fixed land features for referencing the point of impact and the target. The target and the launch point must be geodetically related on the same geodetic datum. The impact area should facilitate the recovery of the nose cone in an undamaged state, if possible.

US Test Facilities

The US Atlantic Ocean test range extends about 4,400 nm from Cape Canaveral in Florida to Ascension Island. This range might be extensible into or across Africa, provided agreements can be reached with the nations concerned. The US has begun operations on a second test range extending from southern California to various island possessions in the Far Pacific. A range distance of 5,500 nm can be achieved by impacting in the vicinity of Guam. Conceivably the Pacific Range might be extended to possibly 6,000-7,000 nm, provided agreements can be reached for the use of certain more remote Pacific islands. Although the US has range facilities of sufficient length to satisfy its present testing needs, a longer range will be required within a few years.

Soviet ICBM Test Facilities

The longest geodesics which lie wholly within the area of the USSR are approximately 4,500 nm in length. The known launch sites at Kapustin Yar and Tyura Tam are considerably east of the western border, reducing the maximum Soviet test range to about 4,000 nm. Probably for security reasons the Soviets have restricted themselves to this 4,000-nm limit until very recently.

The Soviets first claimed to possess an ICBM with 7,500-nm range in December 1958. There has been no indication to date that a Soviet missile

of this range, if it exists, has been tested. Such a test, if made in the Pacific Ocean along the extension of the known Soviet range from Tyura Tam to Kamchatka, could not have taken place without detection by other nations. Within the past few months, reports have indicated that Soviet test missiles have impacted in the Pacific Ocean several hundred miles north of Midway Island. Sightings of surface craft believed to have been equipped to retrieve the nose cone in the impact area indicate the tests to have been a little short of 5,000 nm. If the above mentioned reports have been correctly interpreted, the Soviets are finally coming out from their security shell, as geography dictates they must. The pressure to establish a much longer test range than their existing one was clearly revealed to Govenor Harriman by Khrushchev less than a year ago in a statement which in essence was, "Now we have this long-range weapon system but have no place to test it." The recent tests at about 4,800 nm probably indicate the present Soviet operational capability with the ICBM. The Soviets may be expected to use the open spaces of the Pacific Ocean for missile testing until their range capability increases to 7,000 nm.

The Soviet Dilemma

The space restrictions that limit the testing of the ICBM within the USSR to about 4,000 nm did not come as a sudden realization to the Soviets in 1958. It is more likely that, when the missile program was begun in the USSR more than 12 years ago, the Soviets could foresee that missile ranges up to 7,500 nm would be not only technologically feasible but essential in case of war with the US. Climatically favorable launch site areas in the southern part of either country are approximately 600 nm apart. The Panama Canal is about 7,000 nm from Tyura Tam. We

believe, therefore, that the Soviets have been confronted for a number of years by the perplexing question of where to establish a test range for the ICBM outside the USSR. Until the recent tests in the Pacific Ocean north of Midway, there was no indication as to how the Soviets would solve this problem.

There are several simple criteria that the Soviets would undoubtedly consider in planning adequate range testing facilities for the future. These are:

(1) The range should involve a minimum overflight of non-USSR territory.

(2) The impacting should take place in an area where the Soviets can maintain strictest secrecy.

(3) The physical environment in the impact area should facilitate the recovery of the nose cone in as nearly an undamaged a state as possible.

With these criteria in mind, there seem to be only two practical choices open to the Soviets. The first is a continuing extension eastward beyond Kamchatka of the present range from Tyura Tam to selected areas of impact in the Pacific Ocean. The Soviet dilemma arises from the lack of island possessions along the extension of this range. Midway Island, about 5,250 nm from Tyura Tam is the first oceanic island after leaving the Kamchatka area. The Hawaiians and Johnston Island lie 1,000 nm farther on. Since they are US possessions, the Soviets can derive no benefit from these islands. It should be borne in mind that a ship at sea, when far from land-based navigational aids, cannot expect to determine its true geographical position by celestial navigation to better than 1 mile. If daylight observations are taken of the sun, the

error can be even greater. Missile impacts in open ocean areas are thus subject to serious positional degradation because of the positional uncertainty of the vessels in the impact area. The 1-2 mile error in thus determining the location of the target would be prohibitively large for targeting accuracy tests when the anticipated overall target error is 3-5 miles. If one examines the periphery of the USSR on a globe with these criteria in mind, only two plausible possibilities seem to be open to the Soviets. One is to extend the present transcontinental range from Kapustin Yar or Tyura Tam eastward beyond Kamchatka into the Pacific Ocean to areas of impact at selected distances. The second alternative is to impact missiles of greater range than 6,800 nm upon the barren Antarctic Continent where claims of sovereignty are still unsettled and the area is open to all nations for scientific research. Neither of these possibilities provides an ideal solution to the Soviet need for a long test range for the ICBM, but there is no other.

The Soviet dilemma is attributable directly to the lack of island possessions along the Pacific Ocean extension of their present range. It is not to be expected that any nation will grant the use of its Pacific islands to the Soviets for missile testing purposes. Covert occupation of any of the isolated uninhabited islands for missile test purposes would fail because of certain detection by other nations and the ensuing damage to Soviet prestige. Without islands to serve as target points, monitoring stations, and bases for logistic operations, the Soviets can attempt recovery of nose cones but are denied the acquisition of accurate targeting data. Although Antarctica would provide the fixed target, an impact area favorable for nose cone recovery, and the assurance of secrecy in the impact area, the political stir created by such

use of Antarctica for missile test purposes might lead to uncertain and perhaps threatening acts of reprisal by other nations.

The Pacific Ocean Extension of the Soviet Test Range

Midway Island, about 5,250 nm from Tyura Tam, is the first island of consequence along the extension of the present Soviet test range. The Hawaiian Islands and Johnston Island lie about 1,000 nm farther on. Since these islands belong to the US, the Soviets will have to impact their missiles in open ocean areas up to 6,800 nm without benefit of land based navigational aids, target points, monitoring stations, and communication facilities. It should be borne in mind that observations taken from a ship at sea may be in error by as much as 1 to 5 miles, depending on whether the position is determined by celestial navigation or direct observation of the sun. Although some estimate could be made of the impact point when the nose cone is recovered, it is doubtful that reliable target-error data for the ICBM can be acquired by ships in an open-sea impact area. Soviet vessels might succeed in recovering nose cones in the extension of their present range, but there is no way for them to check reliably upon the targeting accuracy.

Beyond Hawaii along the extension of the Soviet test range is uninterrupted ocean for thousands of miles. To the Southwest of Hawaii lies the great archipelago, with many island groups in the general equatorial belt. The embarrassment of not owning any of these islands would prevent the Soviets from using them as missile targets. To reach some of these island groups would involve overflight of Japan, which the Soviets would probably want to avoid. The best the Soviets can expect by the Pacific Ocean extension of their present range is possible recovery of the nose cone. Without land based planes to fly recovered

materials back to the USSR mainland, the time delay in transport back of the more distant shots would retard the program of testing.

Antarctica as a Possible Soviet Impact Area for the ICBM

Geographically Antarctica is closest to the USSR in the vicinity of Mirnyy where the Soviets have established a permanent station and observatory. The distance from the Tyura Tam to Mirnyy is about 6,800 nm. Antarctica is thus a potential Soviet impact area only for missiles of range greater than 6,800 nm. The Soviets might shorten this distance several hundred miles by setting up a launch site closer to the Afghan border. Depending upon the location of the launch site, the flight to the vicinity of Mirnyy would pass over Afghanistan, Pakistan, and possibly a part of India. After the initial burned-out stages had been dropped in the USSR, overflight of non-USSR territory would total about 750 nm. The flight path would cross the equator at about 75° East and would be inclined to the meridian at this point by 5-10 degrees. The Laccadives, Maldives, and Amsterdam and St. Paul are close to the flight path. Monitoring might be accomplished from some of these islands or from Soviet whaling ships in the South Indian Ocean. The 1,400 nm distance from Mirnyy to the South Pole would permit extension of the range to 8,000 nm if desired.

Many observations of Soviet activity over the past few years collectively point to the likelihood that the Soviets have considered and are still considering the use of Antarctica as an impact area for testing the ICBM at distances 6,800 to 7,500 nm. A number of these observations are listed below:

(1) The very extensive program of Soviet Antarctic activity and data collection during the IGY was much in excess of what

other nations had anticipated. Although the interest of the Soviet Union in Arctic climatology is natural because of its far north geographic location, the Antarctic is so far removed from the USSR that no climatologist has dared to suggest a correlation between meteorological effects observed in Antarctica and weather in the USSR. The extensive glaciological, seismological, meteorological, and gravimetric studies are indeed valuable in contributing to our better understanding of the earth as geologic and astronomic unit. Was the motive behind all this effort designed merely to impress the world with the scientific preeminence of the USSR?

(2) The continued high level of Soviet interest in Antarctica at the conclusion of the IGY was also a surprise to the rest of the world. Whereas the US and other nations were rather anxious to curtail activities for budgetary reasons, the Soviets planned more distant forays into the interior, and present indications suggest the indefinite Soviet occupancy of several stations in Antarctica. One wonders if it should be necessary to continue these Antarctic activities for reasons of gaining more recognition and prestige in the scientific world.

(3) Although the measurement of gravity at various places on the earth is not of the synoptic interest that characterized most IGY activity, the Soviets urged the taking of gravity data along the routes of expeditions during the IGY. The Soviets have been very careful not to reveal their gravity data, which are considered to have strategic significance in the USSR. A

sufficient coverage in Antarctica would lead to the first calculations of deflection angles in that area of the world. The geodetic relationship of Antarctica to other world geodetic datums would be a requisite for any use of Antarctica as an impact area. Gravity data in sufficient abundance will make possible the correction necessary to the astronomical observations to get dependable geodetic coordinates of a target point.

(4) Soviet oceanographic vessels have criscrossed the Indian Ocean during the past few years making gravity observations along critical shores where positional accuracy might eventually be necessary for monitoring stations.

(5) There has been unusual Soviet activity in Afghanistan within the past year, which includes the geodetic surveys in the northern part of the country and the building of roads and airfields. Since the Soviets are present with apparently full Afghan approval, the activity must be programmed to achieve some ultimate Soviet objective. It should be pointed out that good communications and transportation facilities in this area may be required for the guidance of a missile during its early flight stages.

(6) Soviet collection of meteorological data in Antarctica has been very extensive. A number of meteorological rockets were fired from shipboard and from the coast at Mirnyy and yielded data on the variability of wind directions with altitude at very high altitudes. Since the meteorological error associated with the targeting of an ICBM may be as great as a half mile, data over

the area of impact would be essential in order to predict and allow for meteorological effects at the time of missile reentry into the earth's atmosphere.